Technical area

[0001] The invention concerns a composite construction element after the generic term of the requirement 1 and/or. 9 as well as a manufacturing process after the generic term of the requirement 22 and/or. 23.

State of the art

[0002] A composite construction element in accordance with the generic term of the requirement 1 is well-known from the DE 197 24 361 aluminium. In accordance with this teachings e.g. are. from Metallblech, in particular aluminum plate existing bases planarly with a filling layer in form of a foam material core sticks together. This gluing can be manufactured relatively simply in continuous enterprise by creation by broad strips or such to the surfaces of a foam material course extruded withdrawing from a slot die or. Under operating conditions with those the element high thrusts and/or. , is however a bond strength between sheet metal and foam material is suspended high thermal tensions desired or necessary, which cannot be reached with such a gluing so easily.

[0003] Task of the invention is therefore the creation of a composite construction element, which is characterised by improved bond strength with at the same time simple and rational mode of production.

Representation of the invention

[0004] The solution according to invention of this task is by the whole of the characteristics of the requirement 1 and/or. 9 regarding composite construction elements and regarding the manufacturing process by the whole of the characteristics of the requirement 22 and/or. 23 determines.

[0005] The arrangement of a layer from compact polymer material in form and/or material conclusion with the neighbouring layers of first or second kind makes among other things the erstrebte improvement for the bond strength possible by a reduction of the tension and deformation gradients in the transient area between the layers. For the often preferred combinations of metallic layers with layers from polymer foam material such as expanded polystyrene an improvement according to task arises on the one hand as a result of a micro teeth,

i.e. a positive connection between the polymer of the group layer, i.e. the layer of third kind, and the if necessary porous material of the layer of second kind, i.e. the filling layer, and on the other hand by an essentially complete surface with the compact underground at the group layer for the material-conclusive connection, for example by sticking adhesion, to the high-strength and high-rigid layer of first kind, i.e. the base. In addition a relatively strongly measured group layer permits a if necessary necessary reinforcement of a neighbouring sheet metal base, how this would be attainable with larger weight by stronger plate thickness only. Further a compact polymer group layer offers due to easily the elasticity available herein the advantage of a sealing of the filling layer in case of e.g. for formwork boards usual perforation of the base by nailing. In this connection for according to invention planned the polymer group layers determined ranges of the group layer thickness as a function of the filling layer thickness proved group layer thicknesses of at least about 5%, with higher firmness and tightness requirements as far away optimally, i.e. preferably from at least about 10% of the filling layer thickness.

[0006] As special further training of the invention it is intended that the layer of third kind at least partly consists of thermoplastic polymer material. This facilitates above all the application of efficient extruding and shaping technologies. Furthermore result in combination also from polymere foam material existing filling layers and in the case of suitable void structure particularly reliable, i.e. micro-positive, in particular shearing stress-transferring connection of the layers among themselves.

[0007] Special arrangements of the invention with substantial advantages concern the structure of the bases that is called the layers of first kind. In place of actually the sheet metal bases usual with composite construction elements trained layers can be possible in particular according to invention as Kompositelemente, which at least partly exhibit from polymer material existing basic dimensions as well as one in this embedded fiber or wire reinforcing of higher tensile strength and higher modulus of elasticity. Also for this basic dimensions thermoplastic according to invention polymer materials are preferred. In particular in a broad application field bases worked, the few partial from a polymer or a polymer Komposit with a flexible and plastic break deformation as well as with a tensile strength of at least about 50 N/mm< 2> and a Zug-Elastizitätsmodul of at least about 3 kN/mm< 2> exist.

[0008] The choice of materials for the fiber reinforcing offers likewise salient optimization possibilities. According to invention further values of the tensile strength of at least about 2000 N/mm< are with glass fiber reinforcing; 2> , preferably of at least about 3200 N/mm< 2> as well as values for the Zug-Elastizitätsmodul of at least about 50 kN/mm< 2> , favourable-proves from at least about 70 kN/mm< 2> to prefer. For higher demands reinforcing are possible, which at least partly consist of carbon fibers, in the case of a need of larger tenacity and break insensitivity also from aramide fibers. With the latters and other high-quality polymer materials fiber reinforcing with a tensile strength of at least about 1500 N/mm< leave themselves; 2>. preferably of at least about 2600 N/mm< 2> , and with a Zug-Elastizitätsmodul of at least about 50 kN/mm< 2> , preferably of at least about 110 kN/mm< 2> carry out.

[0009] In principle, particularly with smaller firmness, however higher tenacity requirements, come also reinforcing from metallic fibers or wires into consideration, in particular from fibers or wires corrosion resistant metallic according to or coated. The tensile strength should however generally values of at least about 420 N/mm< 2> , preferably of at least about 950 N/mm< 2> , and the Zug-Elastizitätsmodul of values of at least about 70 kN/mm< 2> , preferably of at least about 200 kN/mm< 2> exhibit.

[0010] The reinforcing know arranged fibers as fabrics, clutches of eggs or network with at least in sections to each other under an angle, preferably at least approximately a right angle and/or. Wires trained its. Furthermore reinforcing are possible in form of a confused fiber thing.

[0011] Material and structure of the filling layer concern a substantial target area for training further the invention that is called the layer of second kind. Preferred polymere foam material is used, whereby predominantly thermoplastic, for special requirements however also duroplastischer polymer foam material is possible. For certain optimizations, in particular regarding firmness and weight and/or. regarding the relationship of these Parmeter, at least one filling layer can be planned, which exhibits at least in sections a structure with given porosity gradients.

Short description of the designs and a way to the execution of the invention

[0012] In the graphic representation in accordance with Fig. 1 is the cross section of a plattenförmigen composite construction element as remark example of the invention schematic and simplified represented. _ here be to both surface a layer second kind (2), which as central layer train be, ever a layer third kind (3) from thermoplastic material form and conclusive angeformt. These serve a so-called base as group layers with one layer each of first kind (1), for example a sheet metal from a suitable aluminum alloy as for instance Peraluman < R> , in form and material conclusion. Thus a high-strength and nailable formwork board of considerable form rigidity results. The exterior surfaces of the composite construction element are provided with a surface layer corrosion resistant (4), preferably from a thermoplastic or duroplastischen polymer material.

[0013] Fig. 2 shows a schematic disk cross section with a layer of second kind, which exhibits at least in sections toward from the cross section center to the external layers of first kind (1), functioning as bases, a removing porosity p, as in the diagram in accordance with Fig. is suggested to 3 over the cross section thickness x. Thus two layers result, i.e. the porous filling layer (2a) as well as the layer of third kind (3a), which to the filling layer (2a) an almost disappearing porosity exhibits.

[0014] For the production of composite construction elements according to invention a plant can as in accordance with Fig. 4 to be schematically represented, used.

[0015] For composite construction elements, as they are represented in figure 1, in each case two layers of first kind (1) are advanced in the form of bases to the exterior surfaces of a Kompositstruktur consisting of the layer of second kind (2) and the layers of third kind (3), serving as group layers. The bases (1) consist for example of aluminium strips, textile fabrics or fiber mats, and on the supply roles (7) are stored. The existing and layers (2) and (3), heated in been suitable plastic condition, in an actually usual Coextrusionsanlage (8) are produced for out thermoplastic polymer material such as polypropylene or polypropylene copolymers and united in a combination zone in the entrance of a double volume press (Federal Post Office) with the base volumes (1). Additionally before the entrance into the double volume press (6) the exteriors of the bases (1) can be provided with polymer material (4). The order takes place by means of nozzle coating plants (5). In the case of use of a fiber reinforcing, for example in the form of glass fiber mats, these are embedded afterwards into the polymer material layer (4) (not represented), so that these form the function of a matrix material of a Kompositstruktur. In the double volume press (6) all layers are then transferred of material-conclusive connection between all layer courses under application of pressure in surface normal direction into a planar group body with form and/or. In such a way formed group body becomes within the double volume press and/or. following these, if necessary under thickening and/or spreading and/or. Edge shaping, to a composite construction element or a composite construction element blank solidifies.

[0016] For the production of composite construction elements in Fig. 2 kind shown becomes deviating from managing e.g. a layer of first kind (1) and a layer of second kind, which contains a polymere Schaumbildner, continuously the combination zone supplied. Within the cross section of the layer of second kind the activation and/or doping of the Schaumbildners from the inside of this layer are in such a manner removing stopped toward exterior surface neighbouring to in each case a layer of first kind (1) that on the one hand the porous layer (2a) and on the other hand the layer of third kind (3a) with almost infinitesimal porosity are formed toward to the base (1). The attitude of removing porosity takes place by means of the Coextrusionsanlage (8) in such a manner that for the production of the filling layer (2a) a high extent is used at Schaumbildner in the comparison to the production of the almost not porous layer (3a). The porosity of the layer (3a) amounts to distributed over the Gesamtquerschnitt max. 10% compared with that completely unporösen, sohin compact layer (3) from figure 1.

[0017] However the porosity of the filling layer (2a) amounts to at least about 60% in the comparison to the compact material. In the combination zone and in the following double volume press (6) the layers become again under application of pressure into a planar group body with form and/or. material-conclusive connection transferred. Additionally the group body can be provided likewise by means of a polymer coating (4), in which for the training of a matrix structure a reinforcing is appropriate in the form of glass fiber mats, for example.

[0018] Due to the layer of third kind (3, 3a) example in accordance with manufactured composite construction elements show thus one, in relation to well-known, improved bond strength and can therefore also high thrusts and high thermal tensions, as they arise in the

construction industry usually, be suspended.

Commercial applicability

[0019] The multilevel composite construction element according to invention is characterised opposite well-known by improved bond strength with at the same time simple and rational mode of production. It is suitable accordingly for vierlei applications preferably for vehicle bodyworks, facade constructions and for the boat building.